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Food And Nutrient Intake of Children From Birth To Four Years of Age

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A survey of the food intake of men, women, and children in the United States was made in spring 1965, as a part of the nationwide household food consumption survey conducted by the United States Department of Agriculture. A sample of approximately 6,200 households, consisting of 14,500 individuals, was drawn to be representative of all housekeeping households in the United States.

Information was obtained on the food intake for one day of individual members of the households interviewed. Data were collected for all days of the week for 13 weeks.

The respondent, usually the homemaker of the family, gave information on the food eaten by all members of her household. This information was obtained by the recall method for the day preceding the interview. A 24-hour period was chosen in order to include all between-meal food or snacks as well as regular meals.

The nutritive value of foods was computed mainly using U.S. Department of Agriculture Handbook No. 8, *Composition of Foods: Raw, Processed, Prepared*, revised 1963.

The information reported here is based on an analysis of children's feeding practices in low-income families. More complete data were reported at a workshop held in March 1971, at Warrenton, Virginia, and will appear in the *Proceedings of the Workshop* under the title "Practices of Low-Income Families in Feeding Infants and Small Children." Single copies will be available early in 1972 from the Information Office, Maternal and Child Health Service, 5600 Fishers Lane, Rockville, Md. 20852.

The subsample taken for this report includes 408 infants under 1 year of age and 307 children from 1 to 4 years of age. Nursing infants were not included in these calculations. Infants and children are classified into household groups with yearly incomes of under \$2,000, \$2,000-\$2,999, and \$3,000-\$3,999. Data are also given for infants in households with annual incomes of \$4,000 and over. (See table 1.)

The 715 children under 4 years of age were almost equally divided between girls and boys. Forty-four percent lived in the South. About two-thirds of all the children lived in urban areas.

Table 1.—Distribution of children from birth to 4 years old, by age and family income.

Age group	Total Number	Annual family income			
		Under \$2,000	\$2,000-\$2,999	\$3,000-\$3,999	\$4,000 and over ¹
		Number			
Birth to 4 years	715	97	112	216	290
Birth-2 months	71	1	6	11	53
3-5 months	114	10	8	19	77
6-11 months	223	19	15	29	160
1 year	93	17	25	51	—
2 years	105	21	33	51	—
3 years	109	29	25	55	—

¹ Children 1 through 3 years of age at incomes of \$4,000 and over were in the United States sample but are not tabulated for this report.

FOOD INTAKE

The data are summarized in average quantities of foods eaten, percentage of persons using those foods, and the average quantities of calories and five nutrients in all foods eaten. Food quantities are tabulated by 12 food groups. Tables 2 and 3 give a summary of the average quantities of these foods eaten in 1 day by infants and children, and the percent of children eating food in each group.

Infants (under 1 year)

Practically all infants received some milk and milk products during the 24 hours of the study. Average quantities differed for the three age groups, birth through 2 months, 3 through 5 months, and 6 through 11 months. Average intake of milk and milk products for all infants from birth through 11 months was about 800 grams, or 3¼ cups.

Infants' formula consisted mainly of fresh whole or evaporated milk. Fresh whole milk was consumed by about three-fourths of all infants at incomes of \$4,000 and over, and by more than half of those in the lower income group. Evaporated milk was consumed by infants in the lower income group three times as frequently as in the higher income groups. Almost one-third of the infants at incomes under \$4,000 consumed evaporated milk. Concentrated liquid formulas were consumed by 15 percent of the infants, 12 percent of which were at incomes of \$4,000 and over. About 4 percent of the formulas used were dry formulas, and less than 1 percent were soy formulas.

At both income levels, cereal was the first and most frequently used food, other than formula, by infants under 5 months of age. About half of these infants were consuming formula plus cereal. Most of the remaining infants in this age group had other foods added to their diets, although a small number were still consuming formula alone.

In the United States as a whole, the use of foods other than formula increased considerably after 6 months of age. Baby and/or junior vegetable and meat mixtures (mostly vegetables) were used almost twice as frequently as meat and vegetable mixtures (mostly meats). These two mixtures made up a large part of the meat products consumed by infants under 1 year of age. Use of these meat items started at about 3 months for both income levels. By 6 months, about one-third of all infants had some meat mixtures added to their diets. A small number of children had eggs added to their daily diet after 3 months of age.

At incomes under \$4,000, vegetables alone were infrequently used by infants, birth to 5 months (35 percent). White potatoes, green beans or peas, and deep-yellow vegetables (mostly carrots and sweetpotatoes), were the vegetables most frequently used.

At incomes of \$4,000 and over, a larger number of young infants consumed vegetables. At 3 months of age, 71 percent were consuming them. Deep-yellow vegetables, green beans or peas, and white potatoes were the vegetables most frequently used.

At incomes under \$2,000, no fruit was consumed by the youngest infants (birth through 2 months). Fre-

Table 2.—Average quantities of food eaten by infants and percent eating in one day, all incomes.

Age group	Number of infants	Milk and milk products (calcium equiv.)	Eggs	Meat, poultry, fish	Legumes, nuts	Fats, oils	Grain products (flour equiv.)	Tomatoes, citrus fruit	Dark-green, deep-yellow vegetables	Potatoes	Other vegetables and fruit	Sugar, sweets	Beverages other than milk and juices
<i>Grams</i>													
Birth-2 months	71	680	0	6	0	0	11	8	6	0	53	8	(¹)
3-5 months	114	754	7	27	12	(¹)	16	30	14	1	131	14	2
6-11 months	223	853	27	74	17	3	27	24	16	10	217	8	10
<i>Percent of infants eating</i>													
<i>Percent</i>													
Birth-2 months	71	100	0	7	0	0	65	11	13	0	45	27	1
3-5 months	114	97	14	35	4	3	83	27	25	2	80	25	2
6-11 months	223	99	39	59	11	22	90	17	20	18	86	29	7

¹ Less than 0.5 grams.

Table 3.—Average quantities of food eaten by children 1 to 4 years old (family incomes under \$4,000) and percent eating in one day.

Age group	Number of children	Milk and milk products (calcium equiv.)	Eggs	Meat, poultry, fish	Legumes, nuts	Fats, oils	Grain products (flour equiv.)	Tomatoes, citrus fruit	Dark-green, deep-yellow vegetables	Potatoes	Other vegetables and fruit	Sugar, sweets	Beverages other than milk and juices
<i>Grams</i>													
1 year	93	658	33	97	12	13	57	34	4	23	111	19	82
2 years	105	457	23	107	22	12	68	43	11	29	101	40	134
3 years	109	398	28	117	28	12	65	44	8	21	125	38	111
<i>Percent of children eating</i>													
<i>Percent</i>													
1 year	93	98	49	82	19	55	97	29	12	37	69	47	38
2 years	105	95	32	86	37	54	100	31	17	42	57	71	50
3 years	109	82	44	87	34	60	100	23	13	44	69	53	54

quency of use increased with age and income. Fruits most frequently used were apples and applesauce, citrus fruits and juice (mostly orange juice), and peaches, in that order.

At incomes of \$4,000 and over, use of fruits was more common before 3 months of age. Again, apples and applesauce, and citrus fruit and juice were used most frequently, followed by pears and peaches. Apples and applesauce were consumed more frequently than any other fruit by all age and income groups.

Children (1 to 4 years)

It has been reported that only 10 to 20 percent of all persons in the various age groups in the 1965 survey ate any of the dark-green and deep-yellow vegetables in a day (1). This fact coupled with Lewin's findings that people like what they eat rather than eat what they like prompted a review of the survey schedule form for each child to determine vegetables used by 1- to 4-year-old children (2).

Dark-green and deep-yellow vegetables were used by 10 percent of these children in the North and by 17 percent in the South. Spinach, carrots, and sweetpotatoes were most frequently reported. Other vegetables reported used from this group were collards, broccoli, mustard and turnip greens, and squash.

White potatoes prepared in a variety of ways were used by a considerable number of these children.

In the category "Other Vegetables," corn was used by the largest number of children (about 10 percent), followed by green beans, green peas, vegetable soup and cabbage

(6 to 8 percent). Lima beans, lettuce, and mixed vegetables were used by about 3 to 4 percent of the children. Asparagus, blackeye peas, green onions, cucumbers, sweet peppers, beets, and celery were used by smaller numbers of children. Most of the other vegetables were not used.

NUTRITIVE VALUE OF DIETS

Average daily dietary intakes of calories and five nutrients—protein, calcium, vitamin A value, iron, and ascorbic acid—were calculated. These nutrients were selected because of the general interest in protein intakes of persons on low incomes and our preliminary finding that calcium, iron, vitamin A value, and ascorbic acid were the nutrients most often found below the Recommended Dietary Allowances (RDA's) in the diets of persons in households with incomes under \$3,000.

Primary emphasis is given to comparisons of the average diets of the different age groups rather than to the individual intake values for calories and nutrients. The averages provide data that are representative of the various age groups of children.

Infants (under 1 year)

Average nutritive values of diets of all infants under 1 year of age met the Recommended Dietary Allowances for calories and protein, calcium, vitamin A value, and ascorbic acid. Iron intake was less than half of the recommended amount. Average intakes of protein, calcium, and vitamin A value were over twice the recommended allowances (table 4, p. 4).

Table 4.—Nutritive value of food eaten by infants and percent Recommended Dietary Allowances, all incomes.

Age group	Number of infants	Food energy	Protein	Calcium	Iron	Vitamin A value	Ascorbic acid
		<i>Calories</i>	<i>Grams</i>	<i>Milli-grams</i>	<i>Milli-grams</i>	<i>Inter-national Units</i>	<i>Milli-grams</i>
All infants	408	962	38.9	1,046	5.9	4,550	36
Birth-2 months	71	732	24.1	856	4.3	2,710	33
3-5 months	114	889	33.1	982	5.2	4,320	42
6-11 months	223	1,073	46.6	1,139	6.7	5,250	35
Percent of Recommended Dietary Allowances ¹							
		<i>Percent</i>					
All infants	408	120	259	209	49	303	103
Birth-2 months	71	152	274	214	72	181	94
3-5 months	114	115	236	196	52	288	120
6-11 months	223	119	288	190	45	350	100

¹ National Academy of Sciences-National Research Council, Food and Nutrition Board. Recommended Dietary Allowances. Natl. Acad. Sci. Pub. 1694. 7th Ed. Rev. 1968.

Average diets of infants, birth to 2 months, furnished less than the recommended allowances for iron and ascorbic acid. At incomes under \$4,000, only the ascorbic acid did not meet the RDA. The shortages of iron and ascorbic acid in diets of these infants might be due to the limited use of iron-fortified formulas and because many of them still had not been introduced to iron-fortified cereals and citrus juices.

Infants, 3 to 5 months, had average diets which furnished about half the recommended allowances for iron. This was also true for 3- to 5-month-old infants at incomes under \$4,000. Just as for the younger infants, the shortage of iron for infants, 3 to 5 months, might have resulted from the limited use of iron-fortified formulas and cereals.

Average diets of infants, 6 to 11 months, met the RDA for all nutrients studied except iron. Iron intake was less than half the RDA. This was due to the type of food selected for the infants rather than to an insufficient amount. For example, although infants, 6 to 11 months, ate almost 1 cup of fruit and vegetables, foods that were lower in iron were used in considerably larger amounts than those of higher iron content.

In general, iron and ascorbic acid seem to be the problem nutrients for infants under 1 year of age. Average iron intake for all infants in the 3-year age groups ranged from 28 to 55 percent below the recommendations. Ascorbic acid was slightly less than the RDA for all infants, birth to 2 months old. Ascorbic acid was also 20 percent below recommendations for infants, 6 to 11 months, at incomes under \$4,000.

About one-half of the infants from birth to 11 months were given vitamin or mineral supplements or both during the 24-hour period of the survey. At incomes under \$4,000, 42 percent of infants had supplements compared with 54 percent at incomes of \$4,000 and over.

Children (1 to 4 years)

Average diets of children, 1 to 4 years, at incomes under \$4,000, met the recommended allowances for protein and vitamin A value.

The diets of children, 1 and 2 years of age, furnished less than half the amount of iron recommended. Iron intake by 3-year-olds averaged more than three-fourths of the recommendation for this age group. As the Food and Nutrition Board indicates, however, the recommended allowances for iron are not expected to be met through ordinary foods by all sex-age groups (3). About 6 milligrams of iron per 1,000 calories is all that might reasonably be expected to come from a normal U.S. diet without additional fortification of foods beyond the present levels. On that basis, the normal diets of young children cannot be expected to meet the current recommended intake.

The diets of children 1 to 4 years were 10 to 15 percent below the recommendations for ascorbic acid.

Calcium intake was below the recommended allowance for children of ages 2 to 3 years, but to a lesser extent than for iron and ascorbic acid. One-year-old children had average diets that furnished more than the amount of calcium recommended for this age.

When averages are below the recommended allowances for an age group, it is safe to conclude that some persons within that group had diets in need of improvement. Iron was the nutrient most commonly found below recommended levels in the diets of children 1 to 4 years, either singly or along with other nutrients studied. It was most commonly found below recommendations along with ascorbic acid in diets that were below the RDA's for two nutrients.

Practically all the children 1 to 4 years whose diets met the recommendations for ascorbic acid used tomatoes or citrus fruit while only a small number of those who were below the recommendation for this nutrient used these foods, and then, usually, in small amounts. Dark-green and deep-yellow vegetables were not used to any extent. Milk provided the major source of vitamin A value and ascorbic acid for those children with diets averaging below recommendations in these two nutrients. The vegetable-fruit group needs the greatest improvement in number of servings and in choice in order to meet the servings of various foods recommended for young children (4).

Table 5 shows the average nutritive value of food intake of infants and children, at incomes under \$4,000, on the day of the survey.

REGION, INCOME, AND AGE DIFFERENCES

By region, income, and age, no significant differences (F test) were found in the mean intakes of iron by infants and children under 4 years. Also, no significant differences appeared between mean intakes of food energy and protein by children 1 to 4 years of age. Mean intakes of vitamin A value appeared to be influenced by regional factors, the North having higher values than the South. However, the small number of cases surveyed, combined with exceedingly high intakes by two children, may have influenced test results.

Mean intakes of ascorbic acid by children 1 to 4 years differed by region and income. The North had higher values than the South. The means for the income class \$2,000-\$2,999 were lower than those for income classes under \$2,000 and \$3,000-\$3,999, the latter two being similar to each other. Age was a significant factor in the differences found in the mean intake of calcium by children 1 to 4 years. The 1-year-old child had the highest intake value and the 3-year-old, the lowest.

Differences appeared in the intakes of calories, protein, calcium, vitamin A value, and ascorbic acid by infants under 1 year of age. Intakes increased with age, with the exception of ascorbic acid, which was highest for infants, 3 to 5 months, and lowest for infants, birth to 2 months.

Table 5.—Nutritive value of food eaten by children from birth to 4 years of age (family incomes under \$4,000) and percent Recommended Dietary Allowances.

Age	Number of children	Food energy	Protein	Calcium	Iron	Vitamin A value	Ascorbic acid
		<i>Calories</i>	<i>Grams</i>	<i>Milli-grams</i>	<i>Milli-grams</i>	<i>Inter-national Units</i>	<i>Milli-grams</i>
Birth-2 months	18	774	26.9	943	6.0	1,890	34
3-5 months	37	876	33.4	1,070	5.8	3,330	38
6-11 months	63	1,029	45.9	1,191	6.1	4,730	28
1 year	93	1,255	47.9	962	5.9	3,440	37
2 years	105	1,373	52.9	787	6.7	3,270	35
3 years	109	1,388	52.6	709	7.7	4,000	34
Percent of Recommended Dietary Allowances ¹							
		<i>Percent</i>					
Birth-2 months	18	161	299	236	100	126	97
3-5 months	37	114	239	214	58	222	109
6-11 months	63	114	287	198	41	315	80
1 year	93	114	192	137	39	172	92
2 years	105	110	212	98	45	164	88
3 years	109	99	175	89	77	160	85

¹National Academy of Sciences-National Research Council, Food and Nutrition Board. Recommended Dietary Allowances. Natl. Acad. Sci. Pub. 1694. 7th Ed. Rev. 1968.

CONCLUSIONS

This study on children from birth to 4 years of age showed that:

- Average diets of infants under 1 year met the RDA for more nutrients than did those of children 1 to 4 years.
- On the basis of average diets of infants and children under 4 years of age in low-income families, the major problem was the low intake of iron. Average intakes of ascorbic acid were also below recommended levels for all children 1 to 4 years and all infants except the 3- to 5-month-old. Average intakes of calcium were below recommendations for the 3-year-old and approached the recommendations for the 2-year-old children.
- Average diets were above the RDA for protein and vitamin A value for all infants and children under four years.
- Infants in the United States as a whole, consumed more fresh whole milk than evaporated milk or concentrated liquid formulas. About two-thirds of the infants from birth to 11 months consumed fresh whole milk, while evaporated milk and concentrated liquid formulas were each consumed by about 15 percent of the infants. Dry formulas were used by few infants.

IMPLICATIONS FOR NUTRITION EDUCATION

This report emphasizes the need for nutrition education of mothers with young children. Mothers at all income levels need guidance in the selection of infant's and toddler's foods to meet the nutritional needs of growing children.

Iron and ascorbic acid seemed to be the problem nutrients for infants. The importance of using foods rich in iron must be stressed. As soon as the baby is started on baby cereal, recommendation for the use of cereal with added iron should be made. As soon as fruits and vegetables are added to the diet, the use of citrus fruits to provide ascorbic acid should be emphasized.

The problem nutrients for young children seem to be iron, ascorbic acid, and calcium. Since the use of milk by these children tends to decline as they begin eating from the family food supply, mothers must select foods wisely in order to meet the requirements of these growing children. Emphasis should be placed on the continued use of milk and milk products, the use of enriched and fortified forms of grain products, and the selection of fruits and vegetables that supply iron and ascorbic acid.

A nutrition education program adapted to the needs of young children and their mothers, in different income

levels and regions, should be one of the goals of nutrition educators.

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